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IS 7778 (1975): Methods for Sampling Small Tools [PGD 32: Cutting tools]

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UDC 621·9 : 620·113 (First Reprint JUNE 1988) IS : 7778 - 1975

Indian Standard

(Reaffirmed 1997)

METHODS FOR SAMPLING SMALL TOOLS

1. Scope — Covers the methods for sampling of small tools submitted for inspection in lots.

2. Terminology

2.0 For the purpose of this standard, the following definitions shall apply. For terms not defined below and for any other clarification reference may be made to IS: 2500 (Part I)-1973 'Sampling inspection tables : Part I Inspection by attributes and by count of defects (*first revision*)'.

2.1 *Lot* — All the small tools in a consignment of the same type, grade, class and size manufactured under similar process of production and submitted for inspection at a time.

2.2 *Sample* — Collection of items selected for inspection from a lot.

2.3 *Sampling* — Selection of portion of a lot with a view to ascertaining the quality of the lot on the basis of results obtained by inspecting the selected portion.

2.4 *Defect* — Failure to meet the requirement imposed on an item with respect to a single characteristic.

2.4.1 *Major defect* — A defect that could result in failure or materially reduce the useability of the product for its intended purposes. (As given in Appendix A.)

2.4.2 *Minor defect* — A defect other than major defect that does not materially reduce the useability of the product for its intended purpose. (As given in Appendix A.)

2.5 *Defective* — A small tool which has one or more defects.

2.6 *Acceptance Number* — The maximum permissible number of defectives in the sample(s) for acceptance of a lot (denoted by Ac).

2.7 *Rejection Number* — The minimum number of defectives in the sample(s) for rejection of a lot (denoted by Re).

2.8 *Acceptable Quality Level* (*AQL*) — A designated value of maximum percent defectives in a lot that will be accepted most of the times (approximately 95 times out of 100) by the operation of this sampling plan.

Note — The risk (chance) of rejecting lots of quality better than or equal to AQL is 5 percent which is known as "producer's risk".

2.9 *Lot Tolerance Percent Defective* (*LTPD*) — The percentage of defective tools in a lot that will render it liable for rejection most of the times (approximately 90 times out of 100) by the operation of this sampling plan.

Note — The risk (chance) of acceptance of lots of quality worse than or equal to LTPD is 10 percent which is known as "consumer's risk".

3. Scale of Sampling

3.1 Small tools shall be selected and examined for each lot separately for ascertaining its conformity to the requirements of the relevant specification. The number of small tools to be selected from a lot shall depend on the size of the lot and shall be in accordance with col 1 to 3 of Table 1.

3.2 All these small tools shall be selected at random from a lot and to ensure randomness of selection IS: 4905-1968 'Methods for random sampling' shall be used.

3.3 All the items, in sample selected according to col 3 of Table 1 and col 2 of Table 2, shall be inspected/tested for the corresponding characteristics, irrespective of the rejection number (Re=Ac+1) being obtained earlier.

4. Criteria for Conformity

4.1 *Visual and Dimensional Characteristics* — All the small tools selected according to **3.1** shall be

Small Tools Sectional Committee, EDC 45 [Ref: Doc: EDC 45 (2169)]

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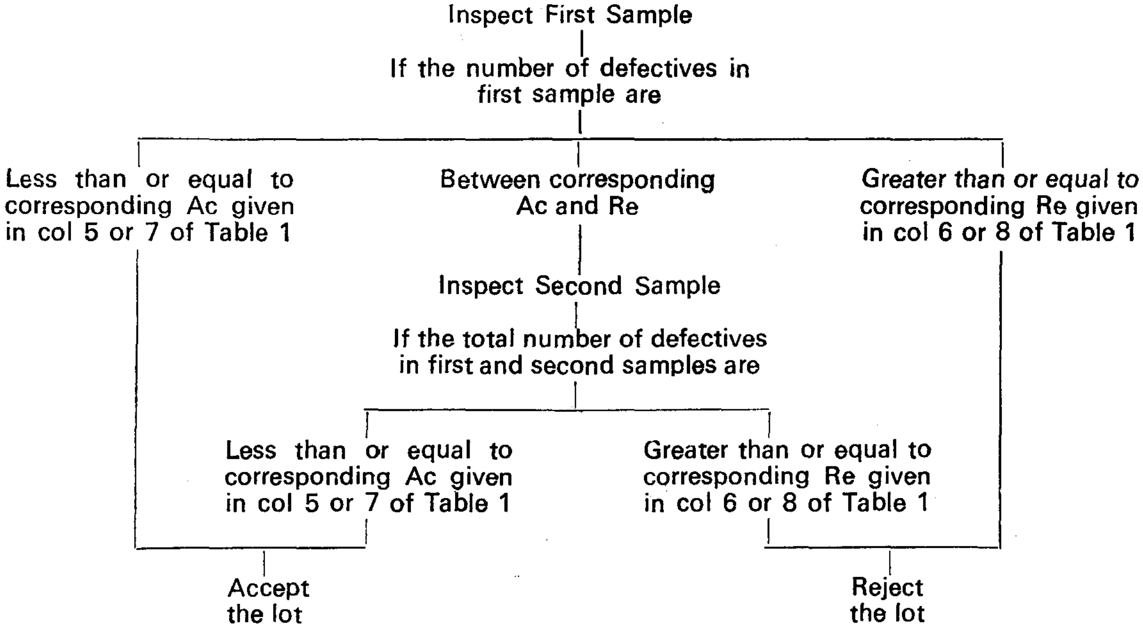
examined for visual and dimensional characteristics. A schematic representation of the procedure for accepting or rejecting a lot is given below:


Inspect First Sample
If the number of defectives in first sample are
Less than or equal to corresponding Ac given in col 5 or 7 of Table 1
Between corresponding Ac and Re
Greater than or equal to corresponding Re given in col 6 or 8 of Table 1
Inspect Second Sample
If the total number of defectives in first and second samples are
Less than or equal to corresponding Ac given in col 5 or 7 of Table 1
Greater than or equal to corresponding Re given in col 6 or 8 of Table 1
Accept the lot
Reject the lot

4.2 *Hardness Tests* — A number of tools corresponding to col 1 and 2 of Table 2 shall be selected and tested for hardness. If the number of defective tools for hardness is less than or equal to the corresponding acceptance number given in col 3 of Table 2, the lot shall be accepted, otherwise rejected.

4.3 *Performance Tests* — In cases where the tests to evaluate the performance of the tools are specified, a sub-sample of size as indicated in col 4 of Table 2 shall be selected from the lots already found satisfactory according to **4.2** and subjected to performance tests. If the number of defective tools is less than or equal to the corresponding acceptance number given in col 5 of Table 2, the lot shall be accepted, otherwise rejected.

TABLE 1 SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY FOR LOT QUALITY FOR VISUAL AND DIMENSIONAL CHARACTERISTICS

(*Clauses* 3.1 *and* 3.3)

Lot Size	Sample AQL	Sample Size	Cumulative Sample Size	Minor Defect		Major Defect	
				Ac	Re	Ac	Re
				4·0		1·5	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Up to 150	First	20	20	1	4	0	2
	Second	20	40	4	5	1	2
151 to 300	First	32	32	2	5	0	3
	Second	32	64	6	7	3	4
301 „ 500	First	50	50	3	7	1	4
	Second	50	100	8	9	4	5
501 „ 1 000	First	80	80	5	9	2	5
	Second	80	160	12	13	6	7
1 001 and above	First	125	125	7	11	3	7
	Second	125	250	18	19	8	9

TABLE 2 SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY FOR LOT QUALITY FOR HARDNESS AND PERFORMANCE TESTS

(*Clauses* 3.3 *and* 4.2)

Lot Size	Hardness Test AQL 1·5%		Performance Test AQL 1·5%	
	Sample Size	Acceptance Number Ac	Sample Size	Acceptance Number Ac
(1)	(2)	(3)	(4)	(5)
Up to 300	8	0	8	0
301 to 1 000	32	1	8	0
1 001 and above	50	2	32	1

APPENDIX A

(*Clauses* 2.4.1 *and* 2.4.2)

CLASSIFICATION OF DEFECTS IN SMALL TOOLS CONFORMING TO INDIAN STANDARDS

A-1. Drills

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
1.	IS : 5100 Twist drills, parallel shanks, stub series for right hand cutting	Diameter of drill, hardness of cutting portion and shank portion, point angle	Length of drill, length of cutting portion
2.	IS : 5101 Twist drills, parallel shanks, jobber series	do	do
3.	IS : 5102 Twist drills, parallel shanks, long series	do	do
4.	IS : 5362 Twist drills, parallel shanks, stub series, left hand cutting for automatics	do	do
5.	IS : 7823 Twist drills, parallel shanks, extra long series	do	do

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
6.	IS : 5103 Twist drills, morse taper shanks	Diameter of drill, morse taper, hardness of cutting portions and shank portion, point angle	Length of drill and length of cutting portion
7.	IS : 5104 Twist drills, oversize morse taper shanks	do	do
8.	IS : 7822 Twist drills, morse taper shanks, extra long series	do	do
9.	IS : 5105 Twist drills, taper square shanks for ratchet braces	Diameter of drill, hardness of cutting portion and shank, point angle, runout on diameter over flute length	do
10.	IS : 5106 Twist drills, taper square shanks for carpenter's braces	do	do
11.	IS : 5364 Twist drills for taper pin holes with taper I : 50	Diameter of drill, shank diameter, point angle, hardness	do
12.	IS : 5365 Core drills, parallel shanks	Diameter of drill, angle of chamfer, hardness	do
13.	IS : 5366 Core drills, morse taper shanks	Diameter of drill, morse taper, angle of chamfer, hardness	do
14.	IS : 7772 Shell core drills	Diameter of drill, angle of chamfer, hardness	Length of drill
15.	IS : 7776 Twist drills for jig boring machines	Diameter of drill, morse taper, hardness, radial runout	Length of drill, length of cutting portion
16.	IS : 5363 Micro-drills	Diameter of drill, diameter of shank, hardness	do
17.	IS : 6708 Centre drills, Type A	Hardness, pilot diameter, length of pilot diameter	Diameter of drill, length of drill
18.	IS : 6709 Centre drills, Type B	do	do
19.	IS : 6710 Centre drills, Type D	do	do

A-2. Reamers

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
1.	IS : 5444 Parallel hand reamers with parallel shanks	Diameter of reamer, hardness, shank diameter, size of square, out of roundness of cutting portion with reference to shank of reamers	Length of cutting edge, length of reamer
2.	IS : 5446 Chucking reamers with parallel shanks	do	do
3.	IS : 5882 Socket reamers with parallel shanks	Size of square, taper on diameter, overall length, hardness	Length of cutting edge
4.	IS : 5445 Long fluted machine reamers with morse taper shanks	Diameter of reamers, hardness, morse taper, size of square, out of roundness of cutting portion with reference to shank of reamer	Length of cutting edge, length of reamer
5.	IS : 5447 Chucking reamers with morse taper shanks	do	do
6.	IS : 5907 Socket reamers with morse taper shanks	Morse taper, overall length, hardness	Length of cutting edge
7.	IS : 5881 Taper pin hand reamers	Diameter of shank, size of square, overall length, hardness	do
8.	IS : 5918 Taper pin machine reamers	Morse taper shank, overall length, hardness	Nominal size

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
9.	IS : 5919 Machine bridge reamers	Morse taper, diameter, hardness	Overall length
10.	IS : 5926 Shell reamers	Diameter of cutter, diameter of bore, length of reamer, hardness	Length of cutting edge
11.	IS : 6091 Machine jig reamers	Diameter of cutter, diameter of guide, morse taper hardness	do

A-3. Milling Cutters and Arbors

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
1.	IS : 2169 Milling arbors:		
	a) Arbors with morse taper	Diameter of arbor, width across flats morse taper, hardness, major diameter and effective diameter of thread and pitch	Overall length, arbor length
	b) Arbors with self release (7/24) taper	Diameter of arbor, taper, hardness, major diameter and effective diameter of thread and pitch	do
	c) Stub arbors with morse taper	Diameter of arbor, morse taper, hardness, major diameter and effective diameter of thread and pitch	do
	d) Stub arbors with self release (7/24) taper	Diameter of arbor, taper, hardness, major diameter and effective diameter of thread and pitch	do
	e) Stub arbors with morse taper with key	Diameter of arbor, morse taper, hardness, major diameter and effective diameter of thread and pitch	do
	f) Stub arbors with self release (7/24) taper with key	Diameter of arbor, taper, hardness, major diameter and effective diameter of thread and pitch	do
	g) Nuts for arbors	Major and effective diameter of thread, pitch and hardness	—
	h) Retaining screws for stub arbors	do	—
2.	IS : 2170 Accessories for milling arbors:		
	a) Driving collar for stub arbors	Chamfer, height of collar, hardness and diameter of bore	Diameter of collar
	b) Bearing bushes for arbors	Diameter of bore, width of keyway, diameter of bush and hardness	Overall length
	c) Spacers for arbors	do	do
	d) End rings for arbors	Diameter of bore, width of keyway, width of ring and hardness	do
3.	IS : 2668 T-slot milling cutters:		
	a) With cylindrical shank	Cutter diameter, cutter width, shank diameter, hardness	Length of cutter
	b) With taper shank	Cutter diameter, cutter width, morse taper, hardness	do

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
4.	IS : 2669 Woodruff key slot milling cutters with parallel shanks	Cutter diameter, cutter width, shank diameter, hardness	Overall length, length of shank
5.	IS : 2670 Thread milling cutter (shell type)	Diameter of cutter, diameter of bore, recess diameter (where applicable), pitch, hardness	Overall length
6.	IS : 2671 Interlocked milling cutters	Diameter of cutter, diameter of bore, cutter width, run-out, hardness	Overall length
7.	IS : 6255 Dove-tail milling cutters	Angle of cutter, diameter of shank, hardness	Length of milling cutter, length of cutting portion
8.	IS : 6256 50° shell end single angle milling cutters	Diameter of cutter, diameter of bore, angle of cutter and hardness	Width of cutter
9.	IS : 6257 Shell end mills	Diameter of cutter, diameter of bore, width of cutter, hardness	Depth of step
10.	IS : 6308 Side and face milling cutters	Diameter of cutter, diameter of bore, hardness	Width of cutter
11.	IS : 6309 Cylindrical milling cutters	do	Length of cutter
12.	IS : 6314 Single corner rounding milling cutters	Diameter of cutter, diameter of bore, radius, hardness, relief angle	—
13.	IS : 6322 Concave milling cutters	do	—
14.	IS : 6323 Convex milling cutters	do	—
15	IS : 6324 Single angle milling cutters	Diameter of cutter, diameter of bore, angle of cutter, hardness	Diameter of spigot
16.	IS : 6325 Double angle milling cutters	do	do
17.	IS : 6326 Equal angle milling cutter	do	do
18.	IS : 6352 Slot milling cutters with parallel shanks	Diameter of cutter, diameter of shank, hardness	Length of cutter, length of cutting portion
19.	IS : 6353 End mills with parallel shanks	do	do
20.	IS : 6354 End mills with morse taper shanks	Diameter of cutter, morse taper, hardness	do
21.	IS : 6355 Keyway milling cutters	Diameter of cutter, diameter of bore, width of cutter	—
22.	IS : 6388 Slot milling cutters with morse taper shanks	Diameter of cutter, morse taper	Length of cutter, length of cutting portion
23.	IS : 6550 Thread milling cutters with parallel shanks	Diameter of cutter, diameter of shank, pitch, hardness	do
24.	IS : 6551 Thread milling cutters with morse taper shanks	Diameter of cutter, morse taper, pitch, hardness	do

A-4. Taps

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
1.	IS : 6172 Hand taps for pipe threads, parallel	Hardness of tap, diameter of tap, size of driving square, major diameter and effective diameter of thread and pitch	Length of tap, length of recessed portions, length of shank, diameter of recessed portion, diameter of shank portion and length of square
2.	IS : 7796 Hand taps for pipe threads, taper	do	do

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
3.	IS : 6175 Hand taps and short machine taps for ISO metric screw threads	Hardness of tap, diameter of tap, size of driving square, major diameter and effective diameter of thread with pitch	Length of tap, length of recess portions, length of shank diameter of recessed portion, diameter of shank portion and length of square
4.	IS : 6174 Nut taps for ISO metric screw threads, coarse	do	do
5.	IS : 7821 Long shank machine taps with diameter from 3 to 24 mm	do	do

A-5. Single Point Turning Tools

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
1.	IS : 2163 Carbide tipped single point turning tools:		
	a) Straight turning tool(ISO 1)	Front clearance angle	Shank dimension, tool length
	b) Cranked turning and facing tool (ISO 2)	do	Angle of cranking, shank dimension, tool length
	c) Cranked finishing tool (ISO 3)	Front clearance angle, front relief and side relief angles	do
	d) Broad turning tool (ISO 4)	Front clearance angle, side clearance angle, side relief angle, width of tool tip	Length of tool and shank dimensions
	e) Cranked facing tool (ISO 5)	Front clearance, side clearance angle	do
	f) Cranked turning tool (ISO 6)	Front clearance, front relief angles	do
	g) Parting off tools (ISO 7)	Front clearance, side clearance and side relief angles, width of tip	do
	h) Pointed turning tool (IND 1)	Point angle, front clearance angle	do
	j) Boring tools (ISO 8)	Front clearance angle, front relief, top rake angle	do
	k) Boring and facing tool (ISO 9)	Front clearance, front relief, top rake angle	do
2.	IS : 2794 Truing tools, single diamond:		
	a) Cylindrical shank	Diameter of shank, weight of diamond	Length of tool
	b) Cylindrical shank and head	do	Length of tool, head length and diameter
	c) Taper shank	Weight of diamond, morse taper of shank, width across flat at gauge plane, overall length, length up to gauge plane	—
	d) Taper shank and head	Morse taper and weight of diameter and radius at smaller end	Thread diameter, length and overall length
3.	IS : 3019 High speed steel single point turning tools:		
	a) Straight turning tool	Hardness, front clearance, side clearance, top rake	Overall length and shank dimensions
	b) Cranked turning and facing tool	Hardness, front clearance, top rake, side rake	do
	c) Cranked finishing tool	Hardness, front clearance, front relief, side relief and top rake angles	Length of tool and shank dimensions

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
	d) Broad turning tool	Hardness, top rake, side relief, side clearance and front clearance angles	Length of tool and shank dimensions
	e) Offset facing tools	Front relief, front clearance, top rake angles, hardness	do
	f) Parting off tool	Hardness, tool tip, width, front and side clearance angles, side relief angle	do
	g) Pointed turning tool	Hardness, front clearance, side clearance, top rake	Overall length and shank dimensions
	h) Boring tools	Front clearance, front and side relief angles, top rake, hardness	Length of tool and shank dimensions
	i) Boring and facing tools	Front clearance, top rake, front relief angles, hardness	do

A-6. General

Sl No.	*Type of Small Tool, Conforming to*	*Major Defects*	*Minor Defects*
1.	IS : 4022 Cemented carbide indexable throwaway inserts:		
	a) Types U and G (Form A)	Thickness, corner radius, measuring dimensions, diameter of inscribed circle	Nominal length
	b) Types U and G (Form B)	do	Rake angles, nominal length
	c) Types U and G (Form C)	Length, thickness, corner radius, measuring dimensions, diameter of gauging cylinder	—
	d) Types U and G (Form D)	do	Rake angles
2.	IS : 5030 Flexible-back metal cutting band-saw blades	Hardness, width, thickness, pitch, departure from flatness	—
3.	IS : 5031 Metal slitting saws	Diameter of saw, bore diameter, width of saw, side clearance and hardness	—
4.	IS : 5618 Circular thread cutting dies for conduit threads	Diameter of cutting thread, outer diameter, pitch, hardness	Width of die
5.	IS : 5693 Countersinks with parallel shanks	Diameter of countersink, pilot, diameter, shank diameter, hardness	Length of countersink, shank length
6.	IS : 5698 Rotary form-relieved gear cutters for spur and helical gears	Cutter diameter, bore diameter, radial position of tooth faces, radial runout on outside diameter and between teeth, runout of faces, runout of side cutting edges of teeth, profile symmetry and error, hardness	Width of cutter
7.	IS : 5702 Flat thread rolling dies	Hardness, tolerance on crest, root dimension, flank angles, flatness of back face, bottom face, die face, pitch, helix angle	—
8.	IS : 5703 Countersinks with morse taper shanks	Morse taper, diameter of pilot, countersink diameter, hardness	Overall length
9.	IS : 5704 Counterbores with parallel shanks	Counterbore diameter, pilot diameter, shank diameter, hardness	do
10.	IS : 5710 Counterbores with morse taper shanks	Morse taper, counterbore diameter, pilot diameter	do